

22-807.fm Page 1 Monday, April 3, 2000 8:42 AM



## Pen Style Digital Multimeter

**Owner's Manual**  
Please read before using this equipment.

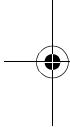
## **Contents**

|  |           |
|--|-----------|
| <b>Features .....</b>                            | <b>3</b>  |
| <b>Safety Precautions .....</b>                  | <b>6</b>  |
| Special Panel Markings .....                     | 8         |
| <b>Specifications .....</b>                      | <b>10</b> |
| <b>Preparation .....</b>                         | <b>13</b> |
| Installing/Replacing Batteries .....             | 13        |
| <b>Using the Meter .....</b>                     | <b>16</b> |
| Turning On the Meter .....                       | 16        |
| Auto Range Control .....                         | 17        |
| Manual Range Control .....                       | 17        |
| Data Hold Function .....                         | 21        |
| <b>Making Measurements .....</b>                 | <b>22</b> |
| Measuring DC/AC Voltage .....                    | 22        |
| Measuring AC Voltage Riding On A DC Source ..... |           |
| Bias .....                                       | 24        |
| Measuring DC/AC Current .....                    | 26        |
| Measuring Resistance .....                       | 27        |
| <b>Resistance Cautions .....</b>                 | <b>28</b> |
| Continuity Check Function .....                  | 31        |
| Checking Diodes .....                            | 32        |
| Logic Test .....                                 | 35        |

© 2000 Tandy Corporation. All Rights Reserved.  
RadioShack and RadioShack.com are registered trademarks  
used by Tandy Corporation.

|                                   |           |
|-----------------------------------|-----------|
| <b>Care and Maintenance .....</b> | <b>37</b> |
| Cleaning .....                    | 37        |
| Replacing the Fuse .....          | 38        |

---



## □ Features

Your RadioShack Pen Style Digital Multimeter is a portable compact multimeter that is ideal for field, lab, shop, and workbench applications. Its 3<sup>3/4</sup>-digit digital display means it can display up to 3.999 units. It measures DC and AC voltage up to 400V, DC and AC current up to 400 mA, and resistance up to 40 MΩ.

Your multimeter's other features include:

**Auto-Ranging with Manual Ranging Override** — automatically selects a range when you measure voltage, resistance, or current, making your meter easier and safer to use. You can manually set the range for situations where you know what values to expect.

**Overload and Transient Protection** — help protect the meter from voltage overload in most ranges.

**Diode Check Function** — lets you safely check semiconductors for open, shorted, or normal junctions.

**Continuity Function** — quickly checks the continuity of wire or traces, and buzzes if the wire or trace is continuous.

**Auto Power Shut-Off** — helps conserve battery power by automatically turning the meter off if you do not change any settings for 30 minutes.

**Logic (Hi and Low) Test with Logic Level Indication** — quickly checks the logic signal and indicates the logic level.

**Full Auto-Polarity Operation** — protects the meter and gives valid measurements even when you connect the leads in reverse polarity.

**Data-Hold Function** — retains the information on the display so you can keep the measurement even after you disconnect the probes.

**Low Battery Indicator** — shows you when you need to replace the batteries.

**Latest Integrated Circuit (IC) and Display Technology** — ensures reliability, accuracy, stability, and ease of operation.

**UL Listed** — passes the stringent safety tests required by Underwriters Laboratories.

**Notes:**

- The UL mark does not indicate that this product has been evaluated by Underwriters Laboratories for the accuracy of its readings.
- Your meter requires two AAA batteries (not supplied) for power.

**Important:**

- Completely read this manual before you use the meter.
- If you are not familiar with multimeters and testing procedures, we suggest you read *Using Your Meter* (RadioShack Cat. No. 62-2039, not supplied) before using the meter.

## **Safety Precautions**

We have taken every precaution in designing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Never apply voltage to the meter that exceeds the limits given in the specifications. Never apply more than 400V DC or 400V RMS AC between the input jacks and ground.
- Use extreme caution when working with voltages above 100V. Always disconnect power from the circuit you are measuring before you connect the red probe and black test clip to high-voltage points.
- Never connect to a source of voltage when you select the diode check, resistance measurement, or current measurement function.
- Always discharge any capacitors of the circuit under test before you attach the red probe and black test clip.

- Always turn off power and disconnect the red probe and the black test clip before you replace the meter's batteries or fuse.
- Never operate the meter unless its back cover is in place and fully closed.
- This equipment is rated for installation category II (maximum 3600 VA).
- Because many AC/DC sets have a potentially hot chassis, be sure the top of your workbench and the floor underneath it are made of non-conductive materials.
- This meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter requires repair, do not try to adjust it yourself. Take it to your local RadioShack store for assistance.

#### **WARNINGS:**

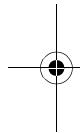
- USE EXTREME CAUTION IN USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH



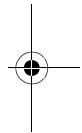
ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES.



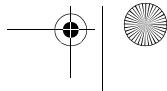
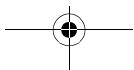
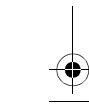
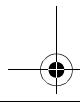
- IF THIS EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.
- TO REDUCE THE RISK OF FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE.
- FOR INDOOR USE ONLY.



## SPECIAL PANEL MARKINGS



For your safety, we have added special markings to the meter's panel and warning label to remind you of the measurement limitations.



|                                |   |
|--------------------------------|---|
| <b>400V<br/>MAX</b>            | To avoid electrical shock or instrument damage, do not connect the red test lead and the black test clip to any source that exceeds 400 volts with respect to earth/ground. |
|                                | <b>Caution:</b> Risk of electric shock! Refer to the complete operation instructions.   |
| <b>400V<br/>400 mA<br/>MAX</b> | The maximum voltage that this meter can measure is 400V DC or AC. The maximum amperage that this meter can measure is 400 mA DC and AC.                                     |
|                                | <b>Caution:</b> Be extra careful when making high-voltage measurements; DO NOT TOUCH TERMINAL OR PROBE ENDS.  |
| <b>CAT II</b>                  | This equipment is rated for installation Category II (maximum 3600 VA).   |
|                                | The meter is protected by double insulation.  |

## **Specifications**

Display ..... LCD 3  $\frac{3}{4}$ -digit digital display

### **DC VOLTS**

Measurement Ranges: 400 mV–4 V–40 V–400 V .....  $\pm 1.5\%$   
of reading,  $\pm 0.2\%$  of full scale,  $\pm 1$  in last digit  
(Max. Measurement: 400V)

### **AC VOLTS**

Measurement Ranges: 400 mV–4 V–40 V–400V  
at 50/60Hz .....  $\pm 2\%$  of reading,  
 $\pm 0.5\%$  of full scale,  $\pm 3$  in last digit  
(Max. Measurement: 400 V RMS at 50/60 Hz)  
45–100 Hz at 400 mV Range .....  $\pm 2.5\%$  of reading,  
 $\pm 0.5\%$  of full scale,  $\pm 3$  in last digit  
45–500Hz at 40 V Range .....  $\pm 2.5\%$  of reading,  
 $\pm 0.5\%$  of full scale,  $\pm 3$  in last digit

### **DC CURRENT**

40–400 mA .....  $\pm 2.5\%$  of reading,  
 $\pm 0.2\%$  of full scale,  $\pm 2$  in last digit

### **AC CURRENT**

40 mA at 50/60Hz .....  $\pm 2.5\%$  of reading,  
 $\pm 1.0\%$  of full scale,  $\pm 3$  in last digit  
400 mA at 50/60Hz .....  $\pm 2.5\%$  of reading,  
 $\pm 0.5\%$  of full scale,  $\pm 3$  in last digit

### RESISTANCE

400 $\Omega$ -4k-40k-400k-4M $\Omega$  .....  $\pm 2.0\%$  of reading,  
 $\pm 0.2\%$  of full scale,  $\pm 1$  in last digit  
40M $\Omega$  .....  $\pm 3.5\%$  of reading,  
 $\pm 0.2\%$  of full scale,  $\pm 1$  in last digit

### LOGIC

Logic Low .....  $<1.0V \pm 0.2V$   
Logic High .....  $>2.0V \pm 0.2V$

### MISCELLANEOUS

Zero Offset ..... 10 digit maximum  
Automatic Power Off ..... 30 minutes after  
last selection  
Range Control ..... Fully Auto-Ranging  
Low Battery Indicator: ..... **BATT** appears when battery  
voltage drops below approximately 2.4 V  
Input Impedance ..... 10M $\Omega$  (DCV/ACV),  
More than 100 M $\Omega$  on 400 mV DC/AC range  
Overrange Indication ..... **.OL** (overload)  
**Caution:** When **.OL** flashes, it indicates that the measurement exceeds the absolute maximum reading. Unless you are measuring resistance, exceeding the maximum limits of any range can damage the meter.  
Polarity ..... Automatic  
Operating Temperature ..... 41° to 104°F  
(5° to 40°C)



Storage Temperature .....  $-4^{\circ}$  to  $140^{\circ}\text{F}$   
 $(-20^{\circ}$  to  $60^{\circ}\text{C}$ )



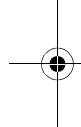
Relative Humidity ..... 80% (Maximum) for  
Temperatures up to  $87.8^{\circ}\text{F}$  ( $31^{\circ}\text{C}$ ),  
Decreasing Linearly to 50% at  $104^{\circ}\text{F}$  ( $40^{\circ}\text{C}$ )

Power Source ..... Two AAA Batteries

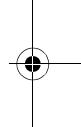
Power Consumption ..... 10 mW (Typical)  
(20 mW for Logic Mode)

Dimensions (HWD) .....  $7\frac{5}{16} \times 1\frac{9}{16} \times 1\frac{1}{8}$  in  
( $185 \times 40 \times 28$  mm)

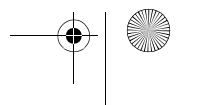
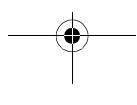
Weight (without batteries) ..... 3 oz  
(85 g)



Included Accessories ..... Black Test Clip,  
Extra 500mA 250V Ceramic Fuse



Specifications are typical; individual units might vary. Specifi-  
cations are subject to change and improvement without no-  
tice.



## ***Preparation***

### **INSTALLING/REPLACING BATTERIES**

Your meter requires two AAA batteries for power. For the best operation and longest life, we recommend RadioShack alkaline batteries.

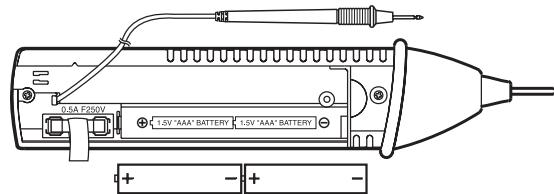
#### **Warnings:**

- To avoid electrical shock, disconnect both of the meter's test leads from any equipment before you install or remove the meter's batteries.
- Do not operate your meter until batteries are properly installed and the battery compartment cover is in place and secured.

#### **Cautions:**

- Use only fresh batteries of the required size.
- Do not mix old and new batteries, different types of batteries (standard, alkaline, or rechargeable), or rechargeable batteries of different capacities.

1. Slide the function switch to **OFF** to turn off the meter if it is on. Then disconnect the test leads if they are connected.
2. Use a Phillips screwdriver to loosen the screw in the battery compartment cover, then lift off the cover.
3. Install the batteries in the battery compartment as indicated by the polarity symbols (+ and -) marked inside.



4. Replace the cover and secure it with the screw.

When **BATT** appears on the left side of the display, replace both batteries.

**Warning:** Dispose of batteries promptly and properly.

**Cautions:**

- Always remove old or weak batteries. Batteries can leak chemicals that can destroy electronic parts.
- If you are not going to use the meter for a few weeks, remove the batteries.

*Preparation*

15

## **Using the Meter**

For the most accurate readings, the temperature should be between 64°F and 82°F (18°C and 28°C) with a maximum relative humidity of 80%.

### **Warnings:**

- Do not try to measure voltage greater than 400V DC/RMS AC.
- Always turn off power to the circuit you are about to measure before you place the red probe and the black test clip into high-voltage points.

**Caution:** Be sure to select the correct function before you touch the red probe and the black test clip to the circuit or component to be tested.

**Note:** For convenience, you can connect the black test lead to the supplied black test clip, if needed, depending on the circuit you are testing.

## **TURNING ON THE METER**

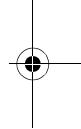
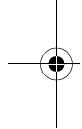
To turn on the meter, slide the function switch from OFF to the desired position. If the function switch is



not set to **OFF** and there is no display, the meter is in the auto power shut-off mode. Slide the function switch to **OFF**, then back to the desired position. All of the display elements briefly appear.

## AUTO RANGE CONTROL

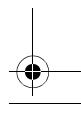
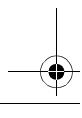
Your multimeter automatically enters the auto range mode when you turn on power or when you select a new function. In the auto range mode, the multimeter automatically selects the range that gives you the best reading. **AUTO** appears and the range is automatically set to the range that gives the best reading.



## MANUAL RANGE CONTROL

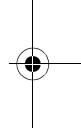
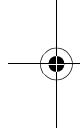
The auto range mode is a convenient feature, but it might be faster to manually set the range when you measure values that you know to be within a certain range.

To select manual range control, repeatedly press **RANGE** until the display shows the desired range. The range steps upward as you press **RANGE** and **RS** appears.



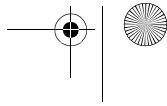
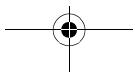
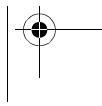
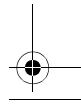
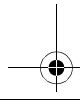
**Cautions:**

- While using the manual range control, if **.OL** (overload) appears and you hear an intermittent tone, immediately set **RANGE** to a higher range.
- If **.OL** (overload) appears, the value you are measuring exceeds the meter's maximum range. This is normal when you measure resistance or a diode, or if you do not have the red probe and black test clip connected to a component. If you are measuring voltage or current, immediately disconnect the probes from the circuit.

**Notes:**

- If you press **RANGE** after you reach the highest range, the multimeter returns to the lowest range.
- When you use manual range control, always begin the measurement with the highest range (especially if you are not sure about the range of the device you are measuring).
- To change from manual to auto range control, press **AUTO**.

Slide the function switch to the desired setting and press **DC/AC  $\Omega/\text{Hz}$**  to switch between the meter's func-



tions. Then connect the red probe and the black test clip to the circuit you want to measure. To measure different circuits, see "Making Measurements" on Page 22.

When the meter automatically selects a range or you manually select a range, you can see the unit of measure on the display to distinguish the range. For example, **mV** appears in the 400mV range and **V** appears in the 400V range. Also, note the position of the decimal. For example, if **.000V** appears, the meter is set to measure less than 4 volts.

Using this formula, read the range in volts, ohms, or amps as indicated by the position of the decimal point.

| Switch Setting  | Range            | Display          |
|-----------------|------------------|------------------|
| V               | 400mV            | ddd.d mV         |
| V               | 4 V              | dddd V           |
| V               | 40 V             | dd.dd V          |
| V               | 400 V            | ddd.d V          |
| mA              | 40 mA            | dd.dd mA         |
| mA              | 400 mA           | ddd.d mA         |
| $\Omega/\infty$ | 400 $\Omega$     | ddd.d $\Omega$   |
| $\Omega/\infty$ | 4 k $\Omega$     | d.ddd k $\Omega$ |
| $\Omega/\infty$ | 40 k $\Omega$    | dd.dd k $\Omega$ |
| $\Omega/\infty$ | 400 k $\Omega$   | ddd.d k $\Omega$ |
| $\Omega/\infty$ | 4 M $\Omega$     | d.ddd M $\Omega$ |
| $\Omega/\infty$ | 40 M $\Omega$    | dd.dd M $\Omega$ |
| ->              | 4V (Fixed Range) | d.ddd V          |

**Notes:**

- The display might show a phantom reading in some DC and AC voltage ranges when the red probe and the black test clip are not connected to a circuit. This is normal. The high input sensitivity produces a "wandering" effect. When you connect the red probe and black test clip to a circuit, a real measurement appears.
- Your meter conserves power by automatically shutting down about 30 minutes after the last time you changed setting (even if you are making measurements). To turn the meter back on, slide the function switch to **OFF** and then back to the desired position.

## DATA HOLD FUNCTION

To retain information on the display for use even after you disconnect the probes, press **HOLD**. Press **HOLD** again to release the information on the display.

## **Making Measurements**

### **MEASURING DC/AC VOLTAGE**

#### **Warnings:**

- Never clamp a test lead on to a hot wire (usually red, black, or blue in AC wiring circuits). If one lead is clamped to a hot wire and you touch the meter's other lead, you could receive an electric shock.
- The maximum input limit for voltage measurement is 400V DC/AC (RMS). To avoid electrical shock and damage to the meter, never try to measure a DC or AC voltage above 400 volts.

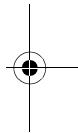
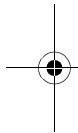
**Note:** The display might show a phantom reading in some DC and AC voltage ranges when the red probe and the black test clip are not connected to a circuit. This is normal. The high input sensitivity produces a "wandering" effect. When you connect the red probe and black test clip to a circuit, a real measurement appears.



Follow these steps to measure DC or AC voltage.

1. Slide the function switch to **V. mV** appears on the display.
2. Press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select **DC** or **AC** measurement.
3. To select manual range control, repeatedly press **RANGE** until **RS** and the desired range appear.

**Caution:** If you do not know the level of the voltage to measure in manual range control, always start at the highest range (400V DC or 400V AC).

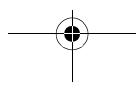
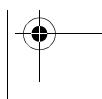
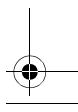
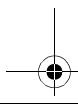


4. To select auto range control, press **AUTO** until **AUTO** appears. Your meter automatically sets itself to the range that gives the best reading.
5. Touch the red probe and the black test clip to the circuit you want to test.

When you measure AC voltages,  $\sim$  and **V** or **mV** appear.

When you measure DC voltages, **V** or **mV** appears.

**Note:** In the 400V and 400 mV ranges, the decimal point appears in the same position (one place to the



left). To distinguish between the two ranges, **mV** appears in the 400 mV range, and **V** appears in the 400 V range.

When you measure DC voltage, **-** appears on the left side of the display if you connected the black test clip to a point in the circuit that has a higher voltage potential than the point where you connect the red probe.

## MEASURING AC VOLTAGE RIDING ON A DC SOURCE BIAS

To measure an AC voltage superimposed on a DC voltage source bias, you must first measure the DC and AC voltages separately, then compute the peak voltage using this formula:

$$\text{Peak voltage} = \text{DC voltage} + \frac{\text{AC voltage}}{.707}$$

**Warning:** To avoid injury to yourself or damage to your meter, never try to measure an AC voltage that is riding on a DC source bias where the peak voltage exceeds 100V with respect to earth ground.

**Caution:** Never try to measure any voltage more than 30V AC on a DC source bias.

1. Slide the function switch to **V**.
2. To measure the DC voltage, press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select DC measurement. Then touch the red probe and black test clip to the circuit you want to test. The display shows the DC voltage.
3. Disconnect the red probe and black test clip from the circuit.
4. To measure the AC voltage, press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select AC measurement, then connect a 0.1 microfarad/100V Mylar capacitor in series with the positive (+) terminal of the voltage source and the red probe.
5. Connect the black test clip to ground. The display shows the AC voltage.
6. When you finish measuring the AC voltage, disconnect the capacitor you connected in Step 4.

**Caution:** If you do not know the level of the voltage to measure in manual range control, always start at the highest range (400VDC or 400VAC).

## MEASURING DC/AC CURRENT

To measure current, you must break the circuit and connect the red probe and the black test clip to two circuit connection points. The connection must be in series with the circuit under test.

**Caution:** Never connect the red probe and black test clip across a voltage source. Doing so can blow the fuse in the meter or damage the circuit under test. The maximum input limit for DC/AC current measurement is 400 mA.

1. Slide the function switch to **mA**.
2. Press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select **DC** or **AC** measurement.
3. To select manual range control, press **RANGE**. **RS** appears on the display.
4. Remove power from the circuit under test and discharge all capacitors.
5. Break the circuit at the appropriate point, then connect the meter's red probe and black test clip in series with the circuit.

**Caution:** Do not apply voltage to the red probe and the black test clip while the function switch is set to **mA**. The connection must be in series with the current.

6. Apply power and read the current.

**Notes:**

- When you measure DC current, and if the measured current's polarity is negative, – appears before the value.
- When you slide the function switch to **mA** and select AC, ~ appears.
- The DC/AC mA range is fuse-protected. If the meter does not show a reading in this range, check the fuse (see "Replacing the Fuse" on Page 38).

## MEASURING RESISTANCE

The resistance-measuring circuit in your meter compares the voltage gained through a known resistance (internal) with the voltage developed across an unknown resistance.

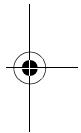
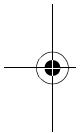


**Warning:** Be sure the circuit under test has all power removed and any associated capacitors are fully discharged before you make a resistance measurement.

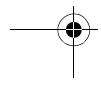
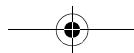
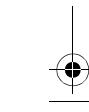
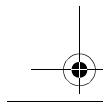
### Resistance Cautions

When you measure resistance, the meter supplies voltage and current to the device you are measuring. The current applied by the meter could damage some devices (such as some integrated circuits).

This table lists each of the meter's ranges and the voltages and current that the meter supplies in each range. For each range:



- A is the open circuit voltage supplied by the meter.
- B is the voltage supplied by the meter when the resistance being measured is equal to the range the meter is in.
- C is the current supplied by the meter.



(All values are measured at the meter's jacks and are typical.)

| Range          | A      | B      | C            |
|----------------|--------|--------|--------------|
| 400 $\Omega$   | 2.99 V | 315 mV | 760 $\mu$ A  |
| 4 k $\Omega$   | 0.86 V | 183 mV | 335 $\mu$ A  |
| 40 k $\Omega$  | 0.58 V | 164 mV | 50 $\mu$ A   |
| 400 k $\Omega$ | 0.57 V | 165 mV | 5.7 $\mu$ A  |
| 4 M $\Omega$   | 0.53 V | 165 mV | 0.5 $\mu$ A  |
| 40 M $\Omega$  | 0.56 V | 165 mV | 0.02 $\mu$ A |

**Caution:** Before using the meter to measure a device's resistance, check the device's voltage tolerance.

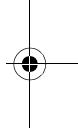
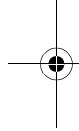
Follow these steps to measure resistance.

1. Slide the function switch to  $\Omega/\cdot\cdot\cdot$ .
2. Press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select the resistance measurement. **K $\Omega$**  appears briefly then **M $\Omega$**  appears.



**Caution:** Your meter has a circuit to protect the resistance range from over-voltage (240V RMS AC for 1 minute). However, to prevent accidentally exceeding the protection circuit's rating and to ensure a correct measurement, never connect the red probe and the black test clip to a source of voltage while the function switch is set to  $\Omega/\cdot\cdot\cdot$  or  $\rightarrow\cdot$ .

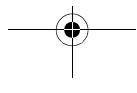
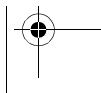
**Note:** With no resistance connected across the red probe and the black test clip (the measured value exceeds  $40\text{ M}\Omega$ ), **O.L.** appears when you set the meter to  $\Omega/\cdot\cdot\cdot$ . This is normal.



3. To select manual range control, repeatedly press **RANGE** until **RS** appears on the display.
4. Touch the red probe and the black test clip across the circuit you want to measure, or remove one of the leads of the component you want to measure from its circuit and touch the red probe and the black test clip across the component.

#### Notes:

- If you are measuring resistance of about  $1\text{ M}\Omega$  or more, the display might take a few seconds to stabilize. This is normal.



- As with the voltage range, use the measuring units that appear on the display to determine the current resistance range. If only  $\Omega$  appears, the values of the measurements are in ohms. If K and  $\Omega$  appear, the meter is measuring kilohms (1kohm= 1000ohm). If M and  $\Omega$  appear, the meter is measuring megohms (1Mohm=1,000,000 ohm).

When you touch the ends of the red probe and the black test clip together, the meter selects the  $400\Omega$  scale and displays a small value. This value is the resistance of the test clip. Note this value and subtract it from the measured value when you measure a very small resistance.

## CONTINUITY CHECK FUNCTION

The continuity check function helps you check for shorted or open electrical circuits.

**Warning:** Be sure the circuit under test has all power removed and any associated capacitors are fully discharged before you make a resistance measurement.

**Caution:** Do not connect the red probe and the black test clip to a source of voltage when you set the meter

to do a continuity test. This could damage the meter or the circuit being tested.

Follow these steps to conduct a continuity check.

1. Slide the function switch to  $\Omega/\cdot\cdot\cdot$ .
2. Press **DC/AC  $\Omega/\cdot\cdot\cdot$**  to select the continuity check. **OL.** and  $\Omega/\cdot\cdot\cdot$  appear.
3. Connect the red probe and black test clip to the circuit to be checked. The display shows the actual resistance value up to  $400\Omega$ . If the circuit resistance is  $50 (\pm 30) \Omega$  or less, the buzzer sounds continuously to indicate there is sufficient continuity.

**Note:** With no resistance connected across the test leads (meaning resistance is infinite), **OL.** appears when you set the meter to measure resistance. This is normal.

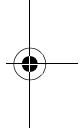
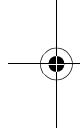
## CHECKING DIODES

This measurement lets you check diodes, transistors, and other semiconductors for opens, shorts, and normal operation. It also lets you determine the forward voltage and polarity for diodes. (This is handy when

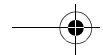
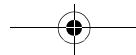
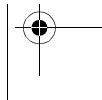
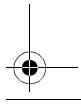
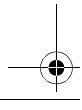


you need to match a diode.) You can also check LEDs using this procedure.

**Caution:** Do not connect the red probe and the black test clip to a source of voltage when you set the function switch to  $\rightarrow\downarrow$ . This could damage the meter or the circuit being tested.



1. Slide the function switch to  $\rightarrow\downarrow$ .
2. Remove power from the circuit under test.
3. Connect the red probe and black test clip to the device you want to check, or remove one of the leads of the component you want to measure from its circuit and connect the red probe and the black test clip to the component.
4. Reverse the red probe and black test clip and note the second reading.



This table shows the type and condition of the tested semiconductor device.

| Diode Type | First Reading              | Second Reading             | Condition |
|------------|----------------------------|----------------------------|-----------|
| Ge         | 0.2–0.4                    | .OL                        | Good      |
| Si         | 0.5–0.7                    | .OL                        | Good      |
| Ge/Si      | .OL                        | .OL                        | Open      |
| Ge/Si      | Very small<br>(about 0.1V) | Very small<br>(about 0.1V) | Shorted   |

**Notes:**

- When you test a silicon-type semiconductor, the values might vary depending on the temperature.
- The values that appear during the diode check show the actual forward voltage (max. 2.0V). If the voltage exceeds 2.0V, .OL appears and you cannot make the diode check.

Many diodes have a stripe or mark on one side. The marked side of the diode indicates the diode's cathode or negative (–) side. The other side is the anode or positive (+) side.

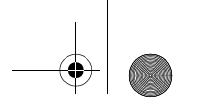
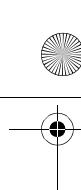
If a diode is not marked, you can use your meter to check the diode's polarity. As you follow the steps under "Checking Diodes" on Page 32, connect the red probe to one side, connect the black test clip to the other side, then measure and note the voltage. Then reverse the red probe and black test clip and measure and note the second reading. The side of the diode where the meter shows a higher voltage using the red probe is the anode (+) side.

## LOGIC TEST

The logic test allows the user to determine if the logic signal under test is a logic high, a logic low, or pulsing.

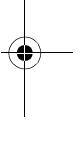
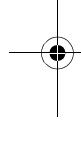
**Caution:** When you slide the function switch to **LOG-IC**, do not connect the red probe and black test clip to a source of voltage greater than 30V. This could damage the meter or the circuit being tested.

1. Slide the function switch to **LOGIC**. **LOGIC** appears on the left side of the display.
2. Connect the red probe to the logic output to be tested and the black test clip to the common ground.

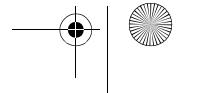
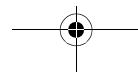


3. If the logic signal under test is a logical high or a logical low, **HI** or **LO** and the logic level appear on the display. If **HI** and **LO** appear at the same time, this means the logic signal under test is a pulsing signal.

**Notes:**



- The meter's frequency test range for pulsing signals is about 300 Hz–5 kHz. If the signal's frequency is out of this range, the meter may only show **HI** or **LO**.
- When you select **LOGIC**, the display might show a reading of about 1.5V before you connect the red probe and the black test clip to a circuit under test. This is normal. An internal bias produces this effect. When you connect to a circuit, you get an accurate measurement.



## **Care and Maintenance**

To enjoy your RadioShack Pen Style Digital Multimeter for a long time:

- Keep the meter dry. If it gets wet, wipe it dry immediately.
- Use and store the meter only in normal temperature environments.
- Handle the meter gently and carefully. Do not drop it.
- Keep the meter away from dust and dirt.

Modifying or tampering with the meter's internal components can cause a malfunction and invalidate its warranty. If your meter is not performing as it should, take it to your local RadioShack store for assistance.

### **CLEANING**

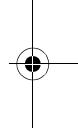
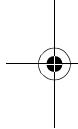
To keep the meter looking new, occasionally wipe it with a cloth slightly dampened with water. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.

**Warnings:**

- Do not let any water drip inside the meter while cleaning it.
- Make sure that the meter is completely dry before using it.

## REPLACING THE FUSE

If the meter does not work, you might need to replace the fuse with the supplied spare fuse. Use a new 500 mA, 250V ceramic fuse.

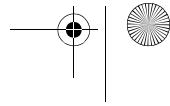
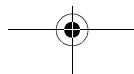
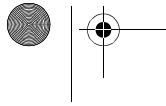
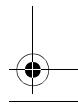
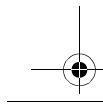


**Warning:** Do not operate your meter until batteries are properly installed and the battery compartment cover is in place and secured.

**Caution:** Do not use a fuse with ratings other than those specified here. Doing so might damage your meter.

Follow these steps to replace the fuse.

1. Slide the function switch to **OFF**.



2. Use a Phillips screwdriver to loosen the screw on the battery compartment cover, then slide off the cover.
3. To remove the fuse, gently pull the red ribbon holding it. The fuse pops out.
4. If the fuse is blown, discard it and save the ribbon. Then insert the spare fuse into the fuse holder through the loop of the attached ribbon.
5. Replace the battery compartment cover and secure it with the screw.

### Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN, EXCEPT AS PROVIDED HEREIN. RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

RadioShack Customer Relations, 200 Taylor Street, 6th Floor, Fort Worth, TX 76102

We Service What We Sell

12/99

RadioShack — A Division  
of Tandy Corporation  
Fort Worth, Texas 76102

22-807  
811082310A  
04A00  
Printed in China